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AGRICULTURAL LIME ANALYSES

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ADDRESS

SCHOOL OF CHEMISTRY, UNIVERSITY OF MARYLAND

COLLEGE PARK, MD.

ANALYSES OF

Agricultural Lime Sold in Maryland

BY THE SCHOOL OF CHEMISTRY

UNIVERSITY OF MARYLAND

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The tables on the following pages contain the results of the analysis of agricultural lime for the year ending November, 1920.

The principal use of agricultural lime is to neutralize acid in the soil and its value for this purpose, either in the commercial oxide or burnt lime, slaked (hydrated) or carbonate of lime (either as ground limestone or oyster shells), depends on the amount of oxide of lime present. Oxide of magnesia is generally present to a greater or lesser extent in limestone and this is slightly more efficient than an equal amount of lime in correcting acidity, so that, for comparative purposes, the amounts of the two oxides should be added. High magnesia content, however, is frequently considered undesirable.

It should be remembered that commercial lime will vary somewhat in composition, even from the same quarry, from time to time, so that a few points in favor of a certain brand as against another brand, may mean nothing, as the figures may be reversed in the next analysis.

All the forms of lime mentioned are good and the form to use depends on local conditions—the kinds available, the comparative prices, cost of freight, distance of haul, ease and cheapness of application, etc.

All forms are best applied on top of plowed ground and harrowed in. Quick lime, hydrated lime and gas lime should be applied some time before sowing the crop. Quick lime soon takes up water and slakes when spread out and then takes up carbonic acid gas and

*Vacant.

is converted to the carbonate, similar, chemically, to the original limestone, but is finely subdivided.

The proper fineness when ground limestone is used is a point on which there are differences of opinion and, again, should depend somewhat on local conditions. All agree that the finer the grinding the quicker the action and the sooner the lime will be used up. Where a coarser product is much cheaper and the freight and hauling comparatively small, the coarser product may be used to advantage, using more of it to the acre and applying less frequently.

In most cases it is desirable that ground limestone, shells, etc., be so fine that the greater part will pass a 60-mesh sieve. In this case much of it will be finer than 60-mesh. That coarser than 20-mesh is very slowly available and much less valuable. The fineness is determined by using sieves with different sizes of mesh. "60-mesh" is a sieve made of wire cloth with 60 wires to the linear inch in both directions.

It will be noted that in case of the quicklimes in the table that the sum of the oxides of lime and magnesia and the insoluble matter will fall short of 100 per cent. The difference is made up of carbon dioxide gas, oxides of iron and alumina, water, etc. In practice the carbon dioxide is never completely driven out of lime in burning; frequently from 2 to 5 per cent, and even more, will remain in the quicklime. The latter also slowly takes up this gas, as well as water, from the air on standing.

Lime, in connection with clover, or other legumes, will, to a large extent, take the place of the expensive nitrogen (ammonia) of commercial fertilizers, but will not greatly relieve the necessity for phosphates and potash.

Lime should be handled, when possible, in carload lots, to avoid unnecessary expense. Where one farmer does not need so much at one time he should be able to arrange with one or more neighbors to get a full car.

A ton of quick lime or two tons of ground stone or shells is a very common amount to apply per acre.

The comparative values of different limes depend, largely, on the respective amounts of actual Lime (Calcium Oxide) present, to which should be added the Magnesia. Insoluble matter, water, carbon dioxide, etc., may be classed as fillers.

Some grinders of limestone and shells give the guarantee as "carbonate of lime." This is unlawful and misleading, as the percentage is nearly twice that of actual lime. 100 lbs. of carbonate of lime contains 56 lbs. of actual lime—oxide of calcium.

ANALYSES OF AGRICULTURAL LIME.

No.	Name of Manufacturer or Agent.	Name of Lime	Place of Sampling.	Calcium Oxide CaO		Magnesium Oxide MgO		Sand & Insoluble (of no value)
				FOUND.	Guaranteed.	FOUND.	Guaranteed.	FOUND.
1149	F. D. Adams, Hagerstown, Md.	*Lime Marl.....	Hagerstown...	39.48	50.00	.36		5.86
1152	Alba Marl Lime Co., Charles Town, W. Va.	*Alba Marl	Charles Town .	52.50 70.00	50.00 70.00	2.32	2.00	1.29
1156	Andrews & Skinner, Cambridge, Md.	Burnt Lime	Easton	50.84	50.00	1.41		4.63
1108	" " " "	Hydrated Shell Lime..	Cambridge	63.03	65.00	.69		6.04
1183	J. E. Baker Co., York, Pa.	Emp. Bur'd Lump Lime	York, Pa.	80.64	85.00	4.18	3.00	.59
	" " " " " "	†Susqu'hanna Hyd. Lime			70.00			
	" " " " " "	†Victor Burned Lime ..			50.00		35.00	
	" " " " " "	†Vic. Fine Gr. Limestone			47.00		2.00	
1157	Baltimore Pulverizing Co., Baltimore, Md.	*Ground Oyster Shells..	Easton	47.93	50.00	2.17		11.77
1125	S. W. Barrick & Son, Woodsboro, Md.	Agr'l Ground Lime....	Woodsboro	65.63	85.00	9.35	2.00	7.91
1162	" " " "	Agr'l Lump Lime	Woodsboro	86.20	85.00	5.26	5.00	5.04
1126	" " " "	Agr'l Hydrated Lime..	Woodsboro	57.40	65.00	3.35	3.00	5.84
1127	" " " "	Burnt Lump Lime	Woodsboro	90.16	90.00	2.90		1.46
1159	Beaver Dam Marble Co.	*Dolomitic Limestone...	Cockeysville...	30.68	30.00	22.32	20.00	1.98

1159	Beaver Dam Marble Co., Cockeysville, Md.	*Dolomitic Limestone...	Cockeysville...	30.68	30.00	22.32	20 00	1.98
1120	" " " "	Unburnt Lime	Cockeysville ..	29.40	30.00	20.94	20.00	3.01
	F. & H. Benning Oyster and Lime Co., Galloways, Md. .	†Ground Oyster Shells..			50.00			
1181	Blair Limestone Co., Martinsburg, W. Va.	Opequon Hydr'd Lime	Martinsburg ..	65.18	65.00	2.03	2.00	10.50
1185	Herbert Bryant's Son, Alexandria, Va.	*Pulverized Oys'r Shells	Alexandria....	48.50	45.00		.68	8.80
	John E. Buffington, Union Bridge, Md.	†Agricultural Lime			90.00			
1146	G. M. Bushey & Son, Inc., Cavetown, Md.	Agr'l Burnt Lump Lime	Cavetown	92.96	90.00	1.52		.45
1101	" " " " " "	Hydrated Lime.....	Cavetown	71.12	70.00	2.06		.66
1109	Chesapeake Shell Lime Co., Crisfield, Md.	Dried Shell Lime.....	Crisfield.....	47.04	75.00	1.07		7.63
1155	" " " "	*Ground Oyster Shells	Crisfield.....	47.04	51.00	.73	.20	10.26
1177	Claremont Marl Products Co., Claremont, Va.	*Marl Lime	Claremont	39.76	47.60	5.15		3.18
1110	Crisfield Shell Lime Co., Crisfield, Md.	Slaked Shell Lime....	Crisfield.....	66.08	75.00	.92		2.63
	Emig Lime Co., Hellam, Pa.	†Agric. Lump Lime			97.53		.94	
1121	Daniel Feeny, Texas, Md.	Burnt Lump Lime.....	Texas.....	73.35	80.00	5.50	5.00	11.84
1178	Fertile Chemical Co., Cleveland, O.	*Lime Fertile..... ...	Cleveland	42.02	35.84	2.96	4.96	1.79
1163	Fountain Rock Lime Co., Woodsboro, Md.	Agric. Lump Lime	Woodsboro	78.50	80.00	8.34	5.00	4.96
1128	" " " "	Burnt Lump Lime.....	Woodsboro	76.72	75.00	15.37	15.00	1.11
1164	" " " "	Ground Lime.....	Woodsboro	59.60	70.00	5.61	5.00	13.61
1129	" " " "	Old Rel. Hydr'd Lime	Woodsboro	60.20	50.00	5.07	2.00	4.75

*Ground Shells or Stone, Mechanical Analysis on page 11.

†Licensed but no sample.

ANALYSES OF AGRICULTURAL LIME.

No.	Name of Manufacturer or Agent.	Name of Lime	Place of Sampling.	Calcium Oxide CaO		Magnesium Oxide MgO		Sand & Insoluble (of no value)
				Found.	Guaranteed.	Found.	Guaranteed.	Found.
1130	Fountain Rock Lime Co., Woodsboro, Md.	Pulverized Lime.....	Woodsboro. ...	62.44	85.00	8.63		12.40
1104	Rob't S. Green, Balto., Md.	Shell Lime.....	Baltimore.....	75.60	80.00	3.07		5.87
1165	M. J. Grove Lime Co., Lime Kiln, Md.	Agric. Lump Lime.....	Grove.....	86.50	85.00	4.45	5.00	3.42
1131	" " "	Ground Lime....	Grove.....	51.24	50.90	7.08	1.25	26.56
1132	" " "	Hydrated Lime.....	Grove.....	56.78	65.00	9.47		10.70
	" " "	†Pulverized Limestone..			50.00			
1169	Hubbard Fertilizer Co. Baltimore, Md.	'Unburnt Oyster Shell Dust	Baltimore.....	51.56	50.00	.68		7.64
1144	John S. Hyde Westminster, Md.	Burnt Lime	Westminster...	61.04	60.00	34.43	30.00	2.21
1160	" " "	Lump Lime	Westminster...	77.61	85.00	3.13		3.06
1134	D. C. Kemp Lime Co., Frederick, Md.	Lump Lime.....	Frederick	84.01	70.00	8.85		2.53
1135	" " " "	Superior Hydr. Lime ..	Frederick	52.36	50.00	15.33	1.00	7.53
1147	Kirk, Souders & Co., Hancock, Md.	*Lime Marl.....	Hancock.....	49.28	50.88	.33	1.00	4.18
	Knickerbocker Lime Co. Philadelphia, Pa.	†Ground Limestone.....			44.00			
1184	" " "	Hydrated Lime.....	Phila., Pa.....	47.60	45.00	24.55	30.00	1.88

	Knickerbocker Lime Co. Philadelphia, Pa.	†Ground Limestone.....			44.00			
1184	" " "	Hydrated Lime.....	Phila., Pa.....	47.60	45.00	24.55	30.00	1.88
	" " "	†Run of Kiln Lime.....			50.00		33.00	
	E. J. Lavino & Co., Phila., Pa.	†Pulverized Limestone..			50.00			
1166	Legore Combination Lime Co., Legore, Md.	Agric. Lump Lime....	Legore.....	79.53	80.00	4.42	5.00	11.94
1136	" " " "	Burnt Lump Lime.....	Legore.....	86.52	85.00	4.96	1.00	1.40
1154	" " " "	Ground Lime.....	Ellicott City...	53.76	50.00	5.16	1.00	5.70
1137	" " " "	Refined Hydrated Lime	Legore.....	53.20	50.00	6.26	1.00	10.71
1122	W. P. Lindsay, Texas, Md.	Burnt Lime.....	Texas.....	86.66	85.00	.		7.37
1161	" " " "	Lump Lime.....	Texas.....	79.52	85.00	3.78		11.40
1111	C. A. Loockerman, Crisfield, Md.	Burnt Shell Lime.....	Crisfield.... .	59.14	60.00	.54		3.66
1138	McAleer Lime Co., Walkersville, Md.	Agric. H. G. Lime	Walkersville ..	54.20	60.00	3.15	2.23	8.65
1168	" " " "	Agric. Lump Lime....	Walkersville ..	70.10	75.00	4.61	5.00	15.34
1167	" " " "	Agri.- Hydrated Lime.	Walkersville ..	58.60	50.00	3.91		12.38
1139	" " " "	Burnt Lump Lime.....	Walkersville ..	76.16	75.00	4.63	5.00	8.08
	Merion Lime & Stone Co., Norristown, Pa.	†Ground Fresh Lime....			50.00		30.00	
1186	" " " "	Hydrated Lime.....	Norristown, Pa.	45.92	45.00	25.35	30.00	1.88
1187	" " " "	Run of Kiln Lime.....	Norristown, Pa.	57.57	50.00	37.53	30.00	.24
1173	Michigan Limestone & Chemical Co., Buffalo, N. Y.	*Calcite Mich. Limestone	Buffalo, N. Y.	54.52	54.50	.60	1.00	.71
	Henry Mosser, Oakland, Md.	†Agric. Burnt Lime			75.00			

*Ground Shells or Stone, Mechanical Analysis on page 11.

†Licensed but no sample.

ANALYSES OF AGRICULTURAL LIME.

No.	Name of Manufacturer or Agent	Name of Line	Place of Sampling	Calcium Oxide CaO		Magnesium Oxide Mgo		Sand & Insoluble (of no value)
				Found.	Guaranteed	Found.	Guaranteed	Found.
1171	Natural Lime Marl Co., Roanoke, Va.	*Lime Marl	Roanoke, Va...	51.52	50.00	.73		3.58
1112	Orem & Winterbottom, Cambridge, Md.	Burnt Shell Lime	Cambridge	82.04	80.00	.69		6.47
1113	" " " "	Hydrated Shell Lime..	Cambridge	66.36	70.00	.69		3.43
1179	Palmer Lime & Stone Co., York, Pa.	Agric. Hydrated Lime.	York, Pa.	64.[illegible]	[illegible].00	6.02	3.00	1.88
1150	" " " " "	Chal. Br. Hydrat. Lime	Mt. Rainier...	61.60	65.00	6.81		2.05
1180	" " " " "	*Ground Limestone	York, Pa.	48.72	48.00	4.80	5.00	.82
1105	Peerless Oyster Co., Baltimore, Md.	Unburned Oyst'r Shells	Baltimore.....	49.50	49.28	1.85		5.46
	Potomac Co., Harpers Ferry, W. Va.	†Hydrated Lime.....			68.00		2.00	
	Potomac Lime Co., Rk. Pt, Md.	†Ground Oyster Shells..			50.00			
1182	Potomac Poultry Food Co., Inc. Baltimore, Md.	*Oyster Shell Lime	Baltimore.....	43.68	50.00	.52		18.60
	Quarryville Lime & Stone Co., Quarryville, Pa.	†Run of Kiln Lime			50.00		2.00	
1153	A. C. Rawlings, Pinto, Md.	Burned Lime.....	Cumberland...	70.78	87.00	4.34		6.32

1102	A. C. Rawlings, Pinto, Md.	Burned Lime	Pinto.	69.44	75.00	2.35		8.13
1148	I. G. Robinson, Hancock, Md.	*Ground Limestone	Hancock	41.72	40.00	2.15		13.19
1145	D. F. Roddy, Emmittsburg, Md.	Burnt Lime	Emmitsburg...	68.04	70.00	15.08	10.00	3.13
1114	Salisbury Lime Co., Salisbury, Md.	Hydrated Oyster Shells	Salisbury.....	62.72	70.00	1.10		10.13
1175	Security Cement & Lime Co., Hagerstown, Md.	Ground Lime	Hagerstown...	87.36	90.00	9.25	3.00	1.24
1151	" " " " "	Hydr'd Berkeley Lime	UpperMarlboro	70.67	70.00	2.32	2.00	1.29
1170	" " " " "	Hydra-Calcite	Baltimore.....	56.02	20.00	2.31	2.00	2.64
1174	" " " " "	Lump Lime	Hagerstowu...	96.50	80.00	1.62		.24
1107	" " " " "	‡Potash Lime	Annapolis....	35.28	34.00	2.69	4.00	18.56
1176	" " " " "	*Pulverized Limestone .	Hagerstown...	50.90	44.00	1.55		2.85
1140	Shank & Etzler, Frederick, Md.	Hydrated Lime.....	Frederick	42.84	40.00	25.54		4.57
1141	" " " "	Lump Lime	Frederick	61.15	60.00	39.42		.60
1142	Charles E. Staley, Frederick, Md.	Burnt Lump Lime	HarmonyGrove	88.76	85.00	1.59		1.62
	Standard Lime & Stone Co., Buckeystown, Md.	†Ground Lime.....			90.00			
1103	" " " "	Hydrated Lime.....	Baltimore.....	72.80	70.00	3.38	2.00	2.49
1143	" " " "	Pulverized Limestone .	Frederick	52.08	50.00	1.23		3.55
	" " " "	†Standard Lime			90.00			
	G. R. Staub, Westminster, Md.	†Agric. Lump Lime			85.25		7.48	
	Steacy & Wilton Co., Wrightsville, Pa.	†Run of Kiln Lime			80.00			

*Ground Shells or Stone, Mechanical Analysis on page 11.
†Licensed but no sample. ‡Potash Found 6.01%; Guaranteed 4.50%.

ANALYSES OF AGRICULTURAL LIME.

No.	Name of Manufacturer or Agent	Name of Line	Place of Sampling	Calcium Oxide CaO		Magnesium Oxide Mgo		Sand & Insoluble (of no value)
				Found.	Guaranteed	Found.	Guaranteed	Found.
1124	Steacy & Wilton Co., Wrightsville, Pa.	Sterling Br'd Hyd. Lime	Bel Air.....	65 80	65.00	3.71	2.50	1.54
1115	Tilghman Lime Co., Salisbury, Md.	Diamond Br. Hy. Shells	Fruitland.....	61.60	60.00	.81	1.00	6.45
1116	" " "	Star Br. Hy. Shells...	Fruitland.....	56.11	50.00	.65	1.00	4.08
1106	Tidewater Portland Cement Co., Union Bridge, Md.	Hydrated Lime.....	Annapolis	66 08	71 00	1.92	.50	1.78
1172	" " "	Lump Lime	Union Bridge..	91.20	92.00	5.83	1.00	.23
1117	W. H. Valliant & Bro., Bellevue, Md.	*Ground Oyster Shells..	Bellevue	48 72	50.00	.89		10.77
1158	" " " " "	*Ground Shell Lime....	Bellevue	48.30	50.00	.50		11.76
1118	" " " " "	Ground Shells	Bellevue	47.04	50.00	.60		9.95
1119	Chas. Warner Co., Wilmington, Del.	Limoid.....	Chestertown ..	48.27	42.00	34.85	28.31	3.19
	" " " "	†Pulverized Burn'd Lime			54 00		36.00	
	" " " "	†Pulverized Limestone..			29.00		19.00	
	" " " "	†Run of Kiln Lime.....			56.00		37.00	

*Mechanical Analysis of Ground Shells or Stone on page 11. †Licensed but no sample.

TABLE II—SHOWING MECHANICAL ANALYSIS OF GROUND LIMESTONE AND GROUND OYSTER SHELL

For the Chemical Analyses of these samples see preceding table

Mechanical Analysis of Ground Shells of Stone on page 11. †Licensed but no sample.

TABLE II—SHOWING MECHANICAL ANALYSIS OF GROUND LIMESTONE AND GROUND OYSTER SHELL

For the Chemical Analyses of these samples see preceding table

Figures are percentages or pounds per hundred

"Mesh" indicates the sieve used: "20 Mesh" has 20 wires to the inch.

No.	Name of Manufacturer or Agent	Name of Lime or Kind	Finer than 100 mesh	Bet. 80 and 100 mesh	Bet. 60 and 80 mesh	Bet. 40 and 60 mesh	Bet. 20 and 40 mesh	Coarser than 20 mesh
1149	F. D. Adams, Hagerstown, Md.	Lime-Marl	34	5	3	5	17	36
1152	Alba Marl Lime Co., Charles Town, W. Va.	Alba Marl	47	3	0	7	14	29
1157	Balto. Pulverizing Co., Balto, Md.	Ground Oyster Shells	28	12	10	20	28	2
1159	Beaver Dam Marble Co., Cockeysville, Md.	Dolometic Limestone	4	4	2	8	20	62
1185	H. Bryants' Sons, Alexandria, Va.	Pulverized Oyster Shells	23	11	8	15	27	16
1155	Crisfield Shell Lime Co., Salisbury, Md.	Ground Oyster Shells	32	11	6	13	24	14
1177	Claremont Marl Products Co., Claremont, Va.	Marl Lime	40	22	9	13	10	6
1178	Fertile Chemical Co., Cleveland, O.	Lime Fertile	62	13	6	6	11	2
1147	Kirk, Souders & Co., Hancock, Md.	Lime Marl	14	5	2	12	24	43
1173	Michigan Limestone & Chem. Co. Buffalo, N. Y.	Calcite Mich. Limestone.	53	9	5	10	16	7
1171	Natural Lime Marl Co., Roanoke, Va.	Lime Marl	37	10	5	11	20	17
1180	Palmer Lime & Stone Co., York, Pa.	Ground Limestone	55	11	4	7	11	12
1182	Potomac Poultry Food Co., Inc., Baltimore Md.	Oystsr Shell Lime	35	14	7	18	24	2
1148	I. G. Robinson, Hancock, Md.	Ground Limestone	15	9	5	13	28	30
1176	Security Cement & Lime Co., Hagerstown, Md.	Pulverized Limestone	81	12	5	2	0	0
1158	W. H. Valliant & Bro., Bellevue, Md	Ground Oyster Shells	24	10	8	12	24	22

LIMING SOILS.

The use of lime is on the increase, as the need for it is becoming better known. Some soils do not need lime and some crops are not benefited by lime. The usual practice is to apply it to land that is being planted with a leguminous crop, as clover, peas, etc., as on a wheat crop when clover is to follow or be sown with the wheat. If it is known that clover will not grow it is probable that lime is required. The simplest chemical test is the litmus test. This test can be made by any one after a little practice. A good way to make the test is as follows:

Blue litmus paper should be cut in pieces about an inch square, though they may be larger or smaller. A number of tumblers of clear glass should be at hand. Wet a piece of the litmus paper with rain-water and place against the inside of a tumbler close to the bottom. The sample of soil to be tested should be moistened with pure water till it has the consistency of a thick mortar or mud and packed in the bottom of the tumbler against the litmus paper. In twenty minutes there will be a decided change in color of the paper from blue to red if the soil is acid, the depth of color depending on the amount of acidity of the soil. Of course the greater the acidity of the soil the more lime will be needed to correct it. In most cases from 500 to 2,000 lbs. per acre of quicklime or twice this amount of ground limestone or oyster shells will be all that will be necessary. When making the litmus test it is desirable to have a number of tests at once so as to compare the colors. If one of the samples is taken from a spot where a pile of brush has been burned within a year or two the test will be more striking. This sample will be alkaline and the litmus should remain a bright blue.

More elaborate tests than the above had best be made in a regular laboratory, for which one should write to "Department of Soils, Experiment Station, College Park, Md."

The following bulletins by the U. S. Department of Agriculture are recommended and may be obtained for 5 cts. each from the Superintendent of Documents, Washington, D. C.

Farmers' Bulletin No. 921, The Principles of the Liming of Soils.

Farmers' Bulletin No. 77, The Liming of Soils.